LIME AND LIMING.

BEING AN ADDRESS DELIVERED AT
THE SWANSEA SHOW OF THE BATH
AND WEST AND SOUTHERN COUNTIES
SOCIETY, 1923.

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LIME AND LIMING.

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The scientific discoveries of the past century have influenced our methods of cultivation and of manuring to a remarkable extent; yet the question of liming still demands most serious consideration by all those who are concerned with the maintenance of soil fertility. Further, although many of the functions of lime in the soil have been known for many years, we still find that present day investigators throw new light on these functions and are continually giving us a more accurate conception of the manner in which lime influences fertility.

In this article it is intended to deal with the question of liming as it affects the present depressing times, and to show that the importance of this question is far greater now than it was during the depression of the 'nineties.

There are historical records showing that the liming of land was extensively practised in this country as far back as two thousand years ago. From that time up to about a hundred years ago dung and some form of lime were practically the only fertilisers used to maintain soil fertility in this country. Various writers also inform us that our forefathers applied lime in particularly heavy dressings.

In a history of Pembrokeshire, published in 1603, it is stated in reference to liming "Now that I have breeflie overrune the manner of tillinge of the lande, I will speake somewhat of the naturalle helpes which are found in the countrie to better the lande, and to make it more fruitful and apt to beare corne and grasse; the cheffest therefore I recon the lyme for that it is most commonlie used and founde to be lesse changde than the marle . . . . . the grounde being thus amended beareth great abundance of Corne for vj or vijen yeres and then requireth some rest, but it is the better for ever after the lyming. This trade of lyming hath ben more used within these thirtie or fortie yeares than in times past and it destroyeth the ffurse, fearne, heath and other like shrubbes growing on the land and bringeth forth a fine and sweete grasse and quite changeth the hue and face of the grounde and hath greatlie enriched those that used it."* In several agricultural reports, published

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* The description of Pembrokeshire by George Owen of Henllys, Lord of Kemes. 1603.

Basic Slag is often regarded as a manure which may be used for liming as well as for supplying phosphate. There are reasons for believing, however, that its value for the former purpose has been much over estimated. Recently it has been found that there are many soils which fail to respond to the action of basic slag unless they also receive a dressing of lime in addition. Several field experiments conducted in different parts of the country have enabled one investigator to come to the following conclusion :—" It seems fair to conclude from this evidence that the continued applications of heavy dressings of basic slag over intervals of three years does not suffice to supply the lime requirement of heavy clay soils under grass. On the contrary, the results indicate that such soils are liable to become even more sour than similar soils left untreated."[*]

More Liming Needed To-day than in the 'Nineties.

It should thus be evident that whereas during the period of agricultural depression of 30 years ago the policy of " no liming " was justifiable, during the period of depression which we are experiencing to-day extensive liming is not only advisable but absolutely essential. In the former case the unexhausted residues of previous dressings of lime assisted the artificial manures to give the biggest possible crop yields at the lowest possible expense. In the latter case our soils are deficient in lime and inclined to be sour as a consequence of continual applications of artificial manures unaccompanied by dressings of lime.

How to Avoid Delay with Supplies of Lime.

The most important reasons given by farmers for not using lime at present are :—

(*a*) the difficulties experienced in some districts in getting supplies of lime promptly delivered ;

(*b*) the prohibitive cost of both lime and labour.

Undoubtedly farmers themselves might do a good deal to assist lime burners and quarry owners to reduce the cost of lime and to arrange for more prompt delivery. At present farmers are apt to cause a good deal of inconvenience both by giving too short a notice regarding their requirements and by concentrating all their orders to a matter of a few weeks in the spring instead of distributing them a little more evenly over the whole year. It should be borne in mind that the bulk of the country's output in lime and limestone is used in the chemical, metallurgical and various other non-agri-

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[*] G. S. Robertson " Basic Slags and Roch Phosphates " Cam. Univ. Press. p. 101.

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cultural industries. The demand for lime for non-agricultural purposes is usually distributed fairly evenly over the greater part of the year. Such a demand is welcomed as it provides a steady and regular trade, whereas agricultural orders for lime are apt to be regarded as a nuisance and be treated accordingly. At some limeworks they are obliged to accumulate and store their products in order to meet the high pressure arising from the concentration of agricultural orders. As this involves double handling it leads to a considerable additional expenditure which is passed on to the farmer.

Liming may be a Labour Saving Operation.

While it must be admitted that liming is an operation which involves much labour, it should be remembered that it leads to a very considerable saving of labour in all the other operations of tillage. In the case of heavy soils especially, the saving in the cost of ploughing, harrowing, cultivating, hoeing and weeding during a four course rotation may balance the cost of liming.

As regards cost of labour it should also be noted that liming may be done at slack times and that it reduces the amount of labour involved in cultivation and weeding in the busy times of spring and summer. By avoiding the practice of liming one may thus be in reality adding to, instead of cutting down, expenses on labour.

On many soils deficient in lime no amount of extra cultivation will enable one to get as fine a tilth as would be possible if they had been limed, consequently the conditions will be less satisfactory for germination of seeds and for giving plants a good start in life.

It is common knowledge that liming is of considerable assistance to clear land of such weeds as Spurrey and Sorrel which are apt to be prevalent on sour soils. In addition farmers should realise that liming, by improving the physical properties of soils and thereby facilitating proper cultivation, makes the conditions much more favourable for the destruction of weeds in general.

The necessity for the application of lime in order to maintain soil fertility becomes evident also when we consider the losses of lime occasioned by cropping and by natural drainage.

The following table indicates the approximate amount of lime contained in the crops most commonly included in a four course rotation, assuming average composition and yields :—

	Lime in lbs. per acre.
Two corn crops (grain and straw)	50
One swede crop (roots and leaves)	60
One crop of grass and clover hay	65
Total calculated as quicklime	175
Total calculated as limestone	312

The foregoing table gives some idea of the extent to which removal of crop exhausts the lime of the soil. When the crops are consumed on the farm a portion of the lime of the crops finds its way back to the soil in the farmyard manure.

The lime of the soil is exhausted by the drainage water to a much more serious extent than by the removal of crops. The actual amount of this loss varies considerably according to the nature of the soil, the manner of cultivation and manuring and the climatic conditions of the district. It is probable that for conditions obtaining on the west coast of this country the amount of lime per acre annually lost in the drainage is likely to be equivalent to anything up to 4 or 5 cwts. of limestone at a moderate estimate.

In view of the continual exhaustion of lime by crops and drainage it is clear that many soils are liable to become sour and to get into an undesirable physical condition unless they receive an occasional dressing of lime.

Some Indirect Effects of Lime.

It is well known that the use of lime is one of the most effective preventive measures against various crop diseases such as Finger-and-Toe. But in addition to its desirable influence upon the health of crops it has been observed that liming is particularly advantageous in its influence upon the state of health of farm animals. In several districts farmers have testified to the writer that not only does liming render the herbage sweeter or more palatable, but that in addition the animals are observed to thrive much better, to mature more quickly, and to present a more healthy appearance on limed than on unlimed land.

In some countries it is maintained that the prevalence of various diseases of farm animals such as Osteo-malacia* or bone-chewing is to be attributed mainly to a deficiency of lime in the soil.

Forms of Lime.

There are on the market several forms of lime which may be used for agricultural purposes.

1. Lump Lime, Quicklime or Burnt Lime.
2. Lime Screenings.
3. Hydrated Lime.
4. Ground Quicklime or Ground Lime.
5. Ground Limestone.
6. Waste Lime.

Farmers are sufficiently well acquainted with most of these forms of lime to render a detailed discussion of their relative merits unnecessary. If their relative values are considered on the basis of lime content, 1 ton of either lump lime or of ground lime is approximately equivalent to $1\frac{1}{3}$ tons of Hydrated Lime and to $1\frac{3}{4}$ tons of Ground Limestone.

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* F. B. Guthrie "Lime on the Farm" Farmers' Bulletin, No. 115, Department of Agriculture, New South Wales.

During recent years, Ground Lime, Hydrated Lime and Ground Limestone have been utilised to a considerable extent. This is due mainly to two advantages connected with their use, viz :—(a) they can be applied in small dressings and (b) they may be conveniently applied with a manure distributor. Nothing can be said against the use of these forms provided the extra price paid for the advantages is not excessive.

" Lime Screenings " is a by-product obtained as a result of screening the Quicklime as drawn from the kiln in order to meet the requirements of those industries which must have all their Quicklime supplied in the form of big lumps without any admixture with the finer material. As the " Screenings " are a by-product they are often sold at a much lower price per ton than the Lump Lime. As a rule they are but little, if any, inferior to the Lump Lime for agricultural purposes. Although they usually contain a fair amount of fuel ash and cinders, they are more likely to have been completely burnt. The big lumps are often liable to contain " cores " of incompletely burnt stone.

The " Waste Limes " obtained from various industries are so variable in composition that it is impossible to make any general statement regarding their value. They may often be used to good advantage in the immediate vicinity of the works but they are rarely worth carrying long distances.

In deciding the value of Ground Limestone its " degree of fineness " is a factor of the utmost importance. In a particular experiment conducted by the writer it was observed that only the particles passing through a 1-100 inch mesh sieve had any appreciable effect during the season of application.*

Lime to Be Used only Where it is Needed.

Although generally there is need for much more liming than is practised at present, the extent to which it is needed may vary from district to district, from farm to farm, and even from field to field on the same farm. It would be a sad mistake if we were to change our present tendency of too little liming to the other extreme of too much liming. With liming as with everything the wise man is he who avoids extremes. Farmers should lime only where lime is needed and where liming would be profitable.

The most suitable person to enlighten the farmer on this point is the farmer himself, because the only reliable way to ascertain whether on a particular field liming would be profitable is to try it. That is, instead of liming everywhere, and instead of liming a whole field anywhere, it would be much better where there exists any doubt about the probable results for the farmer to lime experimentally in the first instance. Liming trials suitable for such a purpose could be carried out by any farmer without involving much trouble or expense. It would only mean that with any given quantity of lime he has decided to purchase the farmer should apply it not in a single lot to one whole field but in several lots to small portions of several fields. Without the necessity of weighing the crops it should be possible by careful observation of the effects on the crops, weeds and soil to ascertain not only which fields needed liming but also the dressings per acre that would be most profitable, and the position in the rotation where liming would be most suitable. Such methodical procedure would ultimately enable the farmer to reap the maximum possible benefit from liming operations.

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* Liming with Special Reference to the Uses of Ground Limestone. J. J. Griffith. Journal Ministry of Agriculture. July, 1921.

How to Solve the Liming Problem.

Assuming that farmers realise the necessity for more liming it is a matter of the utmost importance that something be done to enable them to obtain their supplies of lime at the lowest possible cost and with the minimum amount of labour.

As already suggested, farmers might do a good deal to assist the lime producer. Orders for agricultural lime should be distributed more evenly over the year. Also some means should be adopted to avoid orders for less than 8 or 10 tons at a time. At modern kilns it means but very little extra trouble and expense to load and sheet 10 tons than would be the case with say 4 tons. Further, a considerable advantage in railway freight is obtainable with loads of 8 tons and upwards.

Recently various other suggestions have been made with a view to lowering the cost of lime. A proposal which has been much favoured in many quarters is that of reworking some of the many old dis-used limestone quarries and kilns which are to be found in many parts of the country.

There may be circumstances under which such quarries and kilns might be successfully worked, Before incurring much expenditure in this connection, however, it is important that the prospects should be very carefully considered. There are a number of things which influence the success or otherwise of the lime producer. The quality of the stone, the type of kiln, the cost of fuel, the efficiency of the management and the experience of the workers are some of the factors which influence both the quality of the lime and the cost of production to a much greater extent than is usually realised. With old fashioned kilns, inefficient management and

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inexperienced workmen the amount of fuel consumed might be two or three times what is essential and even then the quicklime produced might be partly over-burnt and partly under-burnt. Suitability of stone, plant and management would have to be carefully considered also where grinding instead of burning might be the object in view. Speaking generally, therefore, it is only under special circumstances that it would be possible to work disused quarries with any prospect of success. In districts situated far away from a railway it might be a help to solve the problem of liming if arrangements were made to re-open some of the old limeworks. Apart from special cases it is likely that our energies would be better directed if we were to reduce the cost of getting supplies from existing sources.

In other countries a good deal is done to assist farmers to get lime. For example in New Zealand and Australia the arrangements indicated below are made in connection with the trade in agricultural lime.

> " Regulations *re* carriage of lime :—
>
> NEW ZEALAND.—Lime carried free of cost for distances not exceeding 100 miles of the kiln.
>
> VICTORIA.—Lime at lower rate provided it is intended for agricultural purposes.
>
> WESTERN AUSTRALIA.—Freight charges for farmers lime considerably lower than in the other States of the Commonwealth."*

It is thus evident that in some countries the question of liming is deemed to be of sufficient importance to call for special trading facilities.

The lime requirements of our soils in this country are such as should demand some organised effort to devise some means or other to remove all obstacles which militate against the practice of liming. The problem is one of great importance to food producers and food consumers alike.

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* F. B. Guthrie. Bulletin No. 115. Department of Agriculture, New South Wales.

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